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Application Number 09/851,363
Amendment dated June 5, 2007
Responsive to Office Action mailed March 5, 2007

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claim 1 (Currently Amended): A routing device comprising:
a plurality of removable interface cards to communicate packets using a network; and
a router module separate from the plurality of removable interface cards, the router module comprising a packet forwarding engine and an interface card concentrator module, wherein the interface card concentrator couples the packet forwarding engine to the plurality of removable interface cards,

wherein the interface card concentrator module communicates packets from at least two of the removable interface cards to the packet forwarding engine,

wherein the packet forwarding engine performs route lookups for the packets received from the at least two removable interface cards by way of the interface card concentrator module, and wherein the packet forwarding engine selects routes for the packets and forwards the packets back to the plurality of removable interface cards via the interface card concentrator module, and

wherein the packet forwarding engine and the interface card concentrator module are integrated into a single unit.

Claim 2 (Previously Presented): The routing device of claim 1, further comprising a midplane coupled between the plurality of removable interface cards and the router module and separating the plurality of removable interface cards from the router module.

Claim 3 (Cancelled).

Claim 4 (Currently Amended): The routing device of claim 1, further comprising at least one memory management circuit to provide data to the interface card concentrator from the packets received from the plurality of removable interface cards.

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Claim 5 (Previously Presented): The routing device of claim 4, further comprising a memory coupled to the interface card concentrator and configured to store the data provided to the interface card concentrator.

Claim 6 (Currently Amended): The routing device of claim 5, wherein the interface card concentrator assembles output bound packets from data stored in the memory and forwards the outbound packets to the plurality of removable interface cards.

Claim 7 (Currently Amended): The routing device of claim 5, wherein the interface card concentrator processes inbound packets received from the plurality of removable interface cards to remove labels from the inbound packets, and stores data from the processed inbound packets in the memory.

Claim 8 (Original): The routing device of claim 5, wherein the memory comprises an SDRAM device.

Claim 9 (Previously Presented): The routing device of claim 4, wherein the memory management circuit is further configured to provide a notification to the packet forwarding engine based on information extracted from an incoming data packet.

Claim 10 (Original): The routing device of claim 9, wherein the extracted information includes at least one of source address information, destination address information, source port information, and destination port information.

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Claim 11 (Currently Amended): The routing device of claim 9,
wherein the packet forwarding module is configured to select the routes for the packets received from the at least two different ones of the plurality of removable interface cards by referencing a forwarding table based on the extracted information, and
wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of removable interface cards.

Claim 12 (Previously Presented): The routing device of claim 11, further comprising a routing engine to store a routing table.

Claim 13 (Previously Presented): The routing device of claim 11, further comprising a memory to store the forwarding table.

Claim 14 (Currently Amended): The routing device of claim 11, wherein the memory management circuit is configured to forward the incoming data packet to one of the plurality of removable interface cards based on the selected route.

Claim 15 (Currently Amended): The routing device of claim 1, further comprising a redundant router module to process the data packets and to forward the data packets between the removable interface cards in response to malfunction of the router module.

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Claim 16 (Previously Presented): A routing device comprising:
a plurality of interface cards to communicate data packets using a network;
a router module comprising a packet processing circuit, a memory management circuit, and a route lookup circuit integrated into a single module separate from the plurality of interface cards; and
a midplane coupled to the router module and to the plurality of interface cards, wherein the midplane communicates to the router module packets received from the network by at least two different ones of the interface cards, and
wherein the router module performs route lookups for the packets received from the at least two different ones of the interface cards to select routes for the packets and forward the packets back to the interface cards in accordance with route information associated with the network.

Claim 17 (Original): The routing device of claim 16, wherein the single module comprises a single printed circuit card that interconnects the packet processing circuit, the memory management circuit, and the route lookup circuit.

Claim 18 (Original): The routing device of claim 16, further comprising a memory coupled to the packet processing circuit and configured to store incoming data.

Claim 19 (Original): The routing device of claim 18, wherein the memory management circuit is configured to provide packet data to the packet processing circuit.

Claim 20 (Original): The routing device of claim 18, wherein the memory is further configured to store outbound data.

Claim 21 (Original): The routing device of claim 18, wherein the memory comprises an SDRAM device.

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Claim 22 (Original): The routing device of claim 16, wherein the memory management circuit is configured to provide a notification to the route lookup circuit based on information extracted from an incoming data packet.

Claim 23 (Original): The routing device of claim 22, wherein the extracted information includes at least one source address information, destination address information, source port information, and destination port information.

Claim 24 (Previously Presented): The routing device of claim 22, wherein the route lookup circuit is configured to select a route for the packets received from the at least two different ones of the interface cards by referencing a forwarding table based on the extracted information, wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of interface cards.

Claim 25 (Original): The routing device of claim 24, wherein the route lookup circuit is configured to select the route by performing a longest prefix match based on the extracted information.

Claim 26 (Previously Presented): The routing device of claim 24, further comprising a routing engine to store a routing table.

Claim 27 (Previously Presented): The routing device of claim 24, further comprising a memory to store the selected route in the forwarding table.

Claim 28 (Original): The routing device of claim 24, wherein the memory management circuit is configured to forward the incoming data packet to an interface card based on the selected route.

Claim 29 (Original): The routing device of claim 16, wherein the packet processing circuit is configured to remove an L2 header from an incoming data packet.

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Claim 30 (Original): The routing device of claim 16, wherein the packet processing circuit is configured to build an L2 header for an outbound data packet.

Claim 31 (Previously Presented): The routing device of claim 16, further comprising a redundant router module to process the data packets and to forward the data packets between the interface cards in response to malfunction of the router module.

Claim 32 (Currently Amended): A routing arrangement comprising:
a crossbar arrangement; and
a plurality of routing devices coupled to the crossbar arrangement, at least one routing device comprising:
a plurality of removable interface cards to communicate data packets using a network; and
a router module separate from the plurality of removable interface cards,
wherein the router module performs route lookups for a first set of the data packets received from the network by a first one of the removable interface cards and for a second set of the data packets received from the network by a second one of the removable interface cards to select routes for the data packets and to forward the data packets between the removable interface cards,
wherein the router module comprises a system control module that performs the route lookups and at least one concentrator module that receives the data packets from at least the first one and the second one of the removable interface cards, and
wherein the system control module and the concentrator module are integrated into a single unit.

Claim 33 (Currently Amended): The routing arrangement of claim 32, further comprising a midplane coupled to the plurality of removable interface cards and to the router module.

Claim 34 (Cancelled).

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Claim 35 (Previously Presented): The routing arrangement of claim 32, further comprising at least one memory management circuit to provide data to the concentrator module.

Claim 36 (Original): The routing arrangement of claim 35, further comprising a memory coupled to the concentrator module and configured to store the data provided to the concentrator module.

Claim 37 (Original): The routing arrangement of claim 36, wherein the memory is further configured to store outbound data.

Claim 38 (Original): The routing arrangement of claim 36, wherein the memory is further configured to store incoming data.

Claim 39 (Original): The routing arrangement of claim 36, wherein the memory comprises an SDRAM device.

Claim 40 (Original): The routing arrangement of claim 35, wherein the memory management circuit is further configured to provide a notification to the system control module based on information extracted from an incoming data packet.

Claim 41 (Original): The routing arrangement of claim 40, wherein the extracted information includes at least one of source address information, destination address information, source port information, and destination port information.

Claim 42 (Currently Amended): The routing arrangement of claim 40, wherein the system control module is configured to select a route by referencing a forwarding table based on the extracted information, wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of removable interface cards.

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Claim 43 (Previously Presented): The routing arrangement of claim 42, further comprising a routing engine to store a routing table.

Claim 44 (Previously Presented): The routing arrangement of claim 42, further comprising a memory to store the selected route in the forwarding table.

Claim 45 (Original): The routing arrangement of claim 42, wherein the memory management circuit is configured to forward the incoming data packet to an interface module based on the selected route.

Claim 46 (Original): The routing arrangement of claim 32, further comprising a redundant router module to process the data packets and to forward the data packets between the interface modules in response to malfunction of the router module.

Claim 47 (Currently Amended): A routing arrangement comprising:
a crossbar arrangement; and
a plurality of routing devices coupled to the crossbar arrangement, at least one routing device comprising:
a plurality of removable interface cards to communicate data packets using a network,
a router module comprising a packet processing circuit, a memory management circuit, and a route lookup circuit integrated into a single module separate from the plurality of removable interface cards, and
a midplane coupled to the router module and to the plurality of removable interface cards,
wherein the midplane communicates to the router module a first set of packets received from the network by a first one of the removable interface cards and a second set of packets received from the network by a different one of the removable interface cards, and
wherein the router module performs route lookups for the first set of packets and the second set of packets in accordance with route information associated with the network.

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Claim 48 (Original): The routing arrangement of claim 47, wherein the single module comprises a single printed circuit card that interconnects the packet processing circuit, the memory management circuit, and the route lookup circuit.

Claim 49 (Original): The routing arrangement of claim 47, further comprising a memory coupled to the packet processing circuit and configured to store incoming data.

Claim 50 (Original): The routing arrangement of claim 49, wherein the memory management circuit is configured to provide packet data to the packet processing circuit.

Claim 51 (Original): The routing arrangement of claim 49, wherein the memory is further configured to store outbound data.

Claim 52 (Original): The routing arrangement of claim 49, wherein the memory comprises an SDRAM device.

Claim 53 (Original): The routing arrangement of claim 47, wherein the memory management circuit is configured to provide a notification to the route lookup circuit based on information extracted from an incoming data packet.

Claim 54 (Original): The routing arrangement of claim 53, wherein the extracted information includes at least one of source address information, destination address information, source port information, and destination port information.

Claim 55 (Currently Amended): The routing arrangement of claim 53, wherein the route lookup circuit is configured to select a route by referencing a forwarding table based on the extracted information, wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of removable interface cards.

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Claim 56 (Original): The routing arrangement of claim 55, wherein the route lookup circuit is configured to select the route by performing a longest prefix match based on the extracted information.

Claim 57 (Original): The routing arrangement of claim 55, further comprising a routing engine to store a routing table.

Claim 58 (Previously Presented): The routing arrangement of claim 55, further comprising a memory to store the selected route in the forwarding table.

Claim 59 (Original): The routing arrangement of claim 55, wherein the memory management circuit is configured to forward the incoming data packet to an interface card based on the selected route.

Claim 60 (Original): The routing arrangement of claim 47, wherein the packet processing circuit is configured to remove an L2 header from an incoming data packet.

Claim 61 (Original): The routing arrangement of claim 47, wherein the packet processing circuit is configured to build an L2 header and rewrite an L3 header for an outbound data packet.

Claim 62 (Original): The routing arrangement of claim 47, further comprising a redundant router module to process the data packets and to forward the data packets between the interface modules in response to malfunction of the router module.

Claim 63 (Previously Presented): A router comprising one hardware board integrally housing an interface concentrator that provides electrical interfaces to receive incoming packets from a plurality of interface cards, a packet processing circuit, a memory management circuit, and a route lookup circuit separate from the interface cards to perform route lookups to select routes for a first packet and a second of the incoming packets received from a network by different ones of the plurality of interface cards.

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Claim 64 (Original): The router of claim 63, wherein the memory management circuit is configured to provide incoming data to the packet processing circuit.

Claim 65 (Previously Presented): The router of claim 63, wherein the memory management circuit is configured to provide a notification to the route lookup circuit based on information extracted from the incoming data packets.

Claim 66 (Previously Presented): The router of claim 65, wherein the extracted information includes at least one of source address information, destination address information, source port information, and destination port information for each of the incoming packets.

Claim 67 (Previously Presented): The router of claim 65, wherein the route lookup circuit is configured to select the routes by referencing a forwarding table based on the extracted information, wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of interface cards.

Claim 68 (Original): The router of claim 67, wherein the route lookup circuit is configured to select the route by performing a longest prefix match based on the extracted information.

Claim 69 (Original): The router of claim 63, wherein the packet processing circuit is configured to remove an L2 header from an incoming data packet.

Claim 70 (Original): The router of claim 63, wherein the packet processing circuit is configured to build an L2 header and rewrite an L3 header for an outbound data packet.

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Claim 71 (Previously Presented): A method of manufacturing a routing device, the method comprising:

- providing a plurality of interface modules to communicate data packets using a network;
- coupling a midplane to the plurality of interface modules; and
- coupling a single router module to the midplane,

wherein the router module is configured to perform route lookups for data packets received from different ones of the interface modules via the midplane to select routes for the packets in accordance with route information associated with the network and forward the packets back to the interface modules by way of the midplane, and

wherein the router module comprises a system control module and at least one concentrator module integrated into a single unit separate from the interface modules.

Claim 72-73 (Cancelled).

Claim 74 (Previously Presented): The method of claim 71, further comprising providing at least one memory management circuit to provide data to the concentrator module.

Claim 75 (Original): The method of claim 74, further comprising:

- coupling a memory to the concentrator module; and
- configuring the memory to store the data provided to the concentrator module.

Claim 76 (Original): The method of claim 75, further comprising configuring the memory to store data associated with at least one of an outbound packet and an inbound packet.

Claim 77 (Original): The method of claim 74, further comprising configuring the memory management circuit to provide a notification to the system control module based on information extracted from an incoming data packet.

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Claim 78 (Previously Presented): The method of claim 77, further comprising configuring the system control module to select a route by referencing a forwarding table based on the extracted information, wherein the forwarding table stores the route information for forwarding data packets received from any of the plurality of interface modules.

Claim 79 (Original): The method of claim 78, further comprising configuring a routing engine to store the routing table.

Claim 80 (Original): The method of claim 71, further comprising configuring a redundant router module to process the data packets and to forward the data packets between the interface modules in response to malfunction of the router module.

Claim 81 (Previously Presented): A method of manufacturing a routing device, the method comprising:

- providing a plurality of interface cards to communicate data packets using a network;
- providing a routing module separate from the plurality of interface cards;

and

- coupling the router module comprising a packet processing circuit, a memory management circuit, and a route lookup circuit integrated into a single module to the plurality of interface cards via a midplane,

- wherein the router module is configured to perform route lookups for the data packets received from different ones of the plurality of interface cards to select routes for the packets in accordance with route information associated with the network and forward the packets back to the interface modules by way of the midplane.

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Claim 82 (Previously Presented): A method of manufacturing a routing arrangement, the method comprising:

- providing a crossbar arrangement; and
- coupling a plurality of routing devices to the crossbar arrangement, at least one routing device comprising:

- a plurality of interface cards to communicate data packets using a network; and
 - a router module separate from the plurality of interface cards to process the data packets and to forward the data packets between the interface cards,

- wherein the router module is configured to perform route lookups for the data packets received from different ones of the interface cards to select routes for the packets in accordance with route information associated with the network.

Claim 83 (Currently Amended): A method of manufacturing a routing arrangement, the method comprising:

- providing a crossbar arrangement; and
- coupling a plurality of routing devices to the crossbar arrangement, at least one routing device comprising:

- a plurality of interface cards to communicate data packets using a network,
 - a midplane coupled to the plurality of interface cards,
 - a router module coupled to the midplane to receive the data packets from the midplane prior to route selection,

- wherein the router module comprises a packet processing circuit, a memory management circuit, and a route lookup circuit integrated into a single module separate from the plurality of interface cards, and

- wherein the router module is configured to perform route lookups for the data packets received from different ones of the interface cards to select routes for the packets in accordance with route information associated with the network, and to forward the packets back to the interface cards ~~by way of~~ via the midplane.

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Claim 84 (Previously Presented): A routing arrangement comprising:

a plurality of routing devices coupled in a crossbar arrangement, at least one routing device comprising:

a plurality of interface modules to communicate data packets using a network,

and

a router module to receive the data packets from at least two different ones of the interface modules, wherein the router module is configured to perform route lookups for the data packets received from the at least two interface modules to select routes for the packets in accordance with route information associated with the network; and

a switch arrangement coupled to the plurality of routing devices and configured to switch control from a first routing device to a second routing device.

Claim 85 (Previously Presented): A routing arrangement comprising:

a plurality of routing devices coupled in a crossbar arrangement, at least one routing device comprising:

a plurality of interface cards to communicate data packets using a network,

a router module comprising a packet processing circuit, a memory management circuit, and a route lookup circuit integrated into a single module separate from the plurality of interface cards and a routing engine, and

a midplane coupled to the router module and to the plurality of interface cards to provide data packets from the interface cards to the router module,

wherein the router module is configured to perform route lookups for the data packets received from any of the interface cards to select routes for the packets in accordance with route information associated with the network and forward the packets back to the interface cards by way of the midplane; and

a switch arrangement coupled to the plurality of routing devices and configured to switch control from a first routing device to a second routing device.